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The Sacred Spear

The sea of green blades that now ripples across the American granary will soon nod heavily with harvest life, heralding anew the ritual of wheat. It is a ritual whose origins are lost in the shadows of history. To primitive man the ripe, golden spike of wild wheat was a sacred spear that helped to sustain life. For thousands of years nomadic man gathered wheat kernels either to eat them raw or toasted for porridge.

One momentous day in man's early home, the Fertile Crescent, an ancient nomad hit upon the idea of saving some seeds of wheat against the next year's hunger. He dropped the seed into furrows that he had scratched into the ground and watched the mystery of wheat unfold. Within a few days the seed softened, swelled, and thrust out of the earth a multitude of delicate green spires. By the season's end, the tiny spires had expanded into vigorous stalks studded with grain for food as well as for next year's sowing. Out of such misty beginnings hunting, fishing, and food gathering gradually gave way to a kind of patch farming that was a forerunner of agriculture.

As agriculture slowly took hold, man began to forsake his nomadic habits, staying put long enough not only to grow food, but to foster the crafts and arts. Thus the story of wheat became ever more interwoven with the story of man. Many of its themes were often immortalized as in the Biblical account of Ruth gleaning after the reapers, or in many of Millet's paintings. Indeed, Western Man and wheat have kept so close an alliance over the centuries that the husbandry of wheat bespeaks order and civilization.

Change, inexorably, comes into the world of wheat. The idyllic gleaning of Ruth bears scant resemblance to harvesting by the rumbling combines which sweep across America's far-flung wheatlands. Today, diverse growing conditions and the scale of operations are vastly different, yet despite the risks imposed by varied climates, insects, and diseases we have bountiful harvests of quality wheat suited for many uses. This success marks a triumph for the agricultural sciences. A vital element is the USDA World Collection of some 26,000 strains of wheat which ARS maintains, largely at Beltsville. Its use is open to every bona fide public and private wheat breeder in the world. The collection, for example, supplied the germ plasm used in developing Norin 10 of Green Revolution fame in Mexico, Pakistan, and India. And by tapping this genetic storehouse, ARS scientists played an important role in developing the specialized varieties that dominate our domestic commercial acreage. In the years ahead, agricultural science will further enhance the well-being of the slender stalk and its burden of harvest, so much a part of our human heritage.

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COVER: Workers collect bollworm and tobacco budworm eggs from cotton plants for laboratory inspection to determine how many were attacked by *Trichogramma* wasps. This count helps in measuring the success of the wasp release program. See page 3 (771K921–31).

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Trichogramma *wasps, released in cages containing sheets spread with Angoumois moth eggs, lay their eggs in those of the moth. The sheets are then cut into 1-inch squares for field release. Here, Mr. Morrison examines moth eggs for wasp parasitization, indicated by color change from white to black (771K928–7).*

WASPS THAT GUARD COTTON

TINY *Trichogramma* wasps that parasitize the eggs of pest insects may reduce the need for several insecticide applications to control bollworms and tobacco budworms in cotton.

At College Station, Tex., ARS entomologist Richard L. Ridgway and entomologist Ron E. Stinner of the Texas Agricultural Experiment Station obtained 50- to 75-percent parasitization of bollworm and tobacco budworm eggs. For this result, the scientists released 100,000 *Trichogramma* wasps in areas ranging from small plots to 48-acre cotton fields. In other tests, releases of 500,000 wasps per

acre resulted in parasitism of up to 95 percent.

The released parasites, harmless to man and livestock, accomplish the critical degree of control that beneficial insects usually do not achieve in nature.

The test results indicate considerable progress toward developing *Trichogramma* as an economical method of controlling bollworms and tobacco budworms. New rearing and release techniques are contributing to the success.

To rear the large numbers of wasps required, for instance, ARS entomologist Richard K. Morrison developed a system producing about 3 million per day. He rears them within the eggs of the Angoumois grain moth, a host insect that is easy to maintain under laboratory conditions.

To coordinate laboratory production with field operations, Dr. Stinner designed procedures to store the developing parasites at low temperatures, thereby controlling their rate of maturation. Adult wasps then emerge from their hosts when most needed rather than too early or late for field releases.

Timing of releases is extremely critical. Bollworm and tobacco budworm eggs must be parasitized within 2½ days after they are laid if they are to be destroyed by *Trichogramma* wasps developing within the eggs. Moreover, mature *Trichogramma* wasps are effective for only a few days in seeking out host eggs in which to deposit their own eggs. Methods developed by Dr. Stinner for storage and manipulation of adult parasite emergence proved effective in meeting the critical timing of releases necessary for good results.

Although insecticide use is often a major deterrent to control by predators, spraying for early-season cotton pests, such as aphids and lygus bugs, would be completed before bollworms become a problem. The risk of killing *Trichogramma* wasps by insecticide would thus be minimal. However, the scientists did observe problems when wasps were employed simultaneously with insecticides in the same vicinity. In a 4- to 5-mile-per-hour wind, drift from aerial application of insecticide killed 75 percent of the wasps a mile downwind. Even in a ½-mile wind, the kill was 30 percent.

The eventual use of other parasites, predators, insect diseases, and resistant crop varieties in an integrated control program could help reduce insecticide use, thus alleviating problems of drift and environmental contamination.

The scientists are making improvements in mass production and field distribution, and further tests will be conducted on a larger scale this year. □

ARS technician Ruben L. Garcia releases parasites in citrus grove. The parasites are packed in small boxes with excelsior and then shaken onto leaves in the test plots (PN–2007).

for citrus pest control

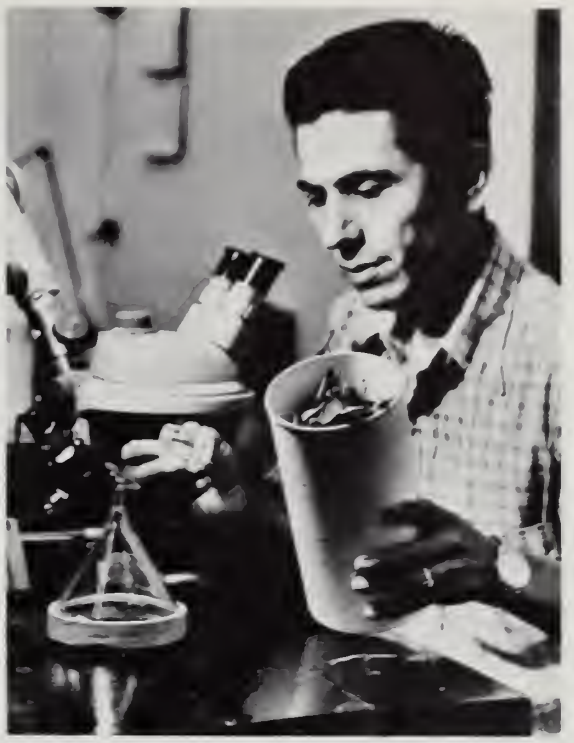
BUILDING UP THE NATIVES

GIVEN A LITTLE HELP, a native parasite may prove effective in controlling brown soft scale, one of the most serious insect pests of citrus in the Lower Rio Grande Valley of Texas.

In tests spanning several years, ARS entomologist William G. Hart, Weslaco, Tex., mass-reared and released this parasite, *Microterys flavus*, one of the scale's two major predators in Texas.

Normally, the other parasite, *Coccophagus lycimnia*, predominates, but it seldom seems to exert effective control. Its complex life cycle tends to rule out its use in a mass-rearing program. On rare occasions when *M. flavus* becomes dominant, it rapidly brings the brown soft scale under control. Both parasites are wasp-like and native to Texas.

In tests conducted by Mr. Hart, *C. lycimnia* remained the predominant



ARS technician Moises Garza evaluates effectiveness of releases by counting parasites recovered from scales on citrus leaves (PN–2008).

parasite in sprayed orchards while scale populations were increasing sharply in the late summer months. In the bio-control groves, *M. flavus* predominated and continued to control the scale in ensuing years. The effect of *M. flavus* was not immediate, but surprisingly it exerted its influence after the scale was brought down to low population levels. Scales collected in the bio-control groves during 3 years after mass releases were heavily parasitized.

Build-up of scale infestations has been associated with drift from methyl parathion spraying to control insects in nearby cotton fields. However, Mr. Hart found that both scale parasites survived in significant numbers despite two applications of methyl parathion on an orchard plot. In separate laboratory studies, he found that exposure to this pesticide stimulated brown soft scale reproduction. This may account for the rapid increase in scale populations in sprayed orchards despite the presence of the parasites.

Timing of the releases is a critical factor for successful control. When releases were made as late as early summer, hot and dry conditions inhibited establishment of *M. flavus*. There was also extensive drift of cotton sprays during that period.

Another factor requiring attention is the defensive capability of the scale to ward off parasite attacks. This defensive action causes many of the *M. flavus* eggs to become encapsulated, reducing the establishment of viable parasite populations. Efforts are being made to produce a strain of *M. flavus* with greater resistance to this mechanism.

Still another factor is the competition *M. flavus* has with other native parasite species such as *C. lycimnia*. Strip-spraying orchards to reduce scale populations and provide conditions where *M. flavus* is most effective provided some help. Development of *M. flavus* strains resistant to selective insecticides or miticides also offers promise in giving *M. flavus* an advantage over highly competitive and less effective parasite species.

The advantages of mass-rearing and releasing the native parasite for brown soft scale control is apparent. If some obstacles can be manipulated to provide slight advantages to the parasite, it may prove effective under field conditions, and the techniques employed may be useful against many other insect pests of crops. □

Breeding to improve

NITROGEN-FIXING MICROBES

In the foreseeable future, scientists may be able to breed a universal, inoculant strain of bacteria that can fix atmospheric nitrogen efficiently for all the legumes.

ARS-sponsored research in Poland has established that desirable traits from selected donor strains of the bacterium *Rhizobium* can be consistently transferred to other strains of the same genus.

The *Rhizobia*, which fix atmospheric nitrogen into nutrients in the root nodules of legumes, vary in their ability to do this. Purpose of the Polish study was to verify the practicality of using genetic modification to improve the nitrogen-fixation characteristics.

The two most common methods of transferring characteristics in microbes are by "transduction" and "transformation." In transduction, an infective but nonlethal bacteriophage is used to carry genetic traits from donor to recipient. A bacteriophage is a minute virus which usually invades and destrops bacteria cells. In transformation, the recipient cells are incubated under special conditions in a medium containing deoxyribonucleic acid (DNA) extracted from the donor strain. This DNA carries the traits to be transferred.

Dr. James D. Menzies, ARS microbiologist and sponsoring scientist, Beltsville, Md., says that although transduction is not to be ruled out as a genetic tool, the Polish project has established easily followed procedures for using the transformation procedure in *Rhizobium*.

"In the past," he said, "the transformation process was effective in transferring only simple drug resistance or similar characteristics also easily obtained by ordinary mutation. However, the Poles found that the complicated genetic character of infectivity that instigates nitrogen-fixation capabilities can be transferred as well."

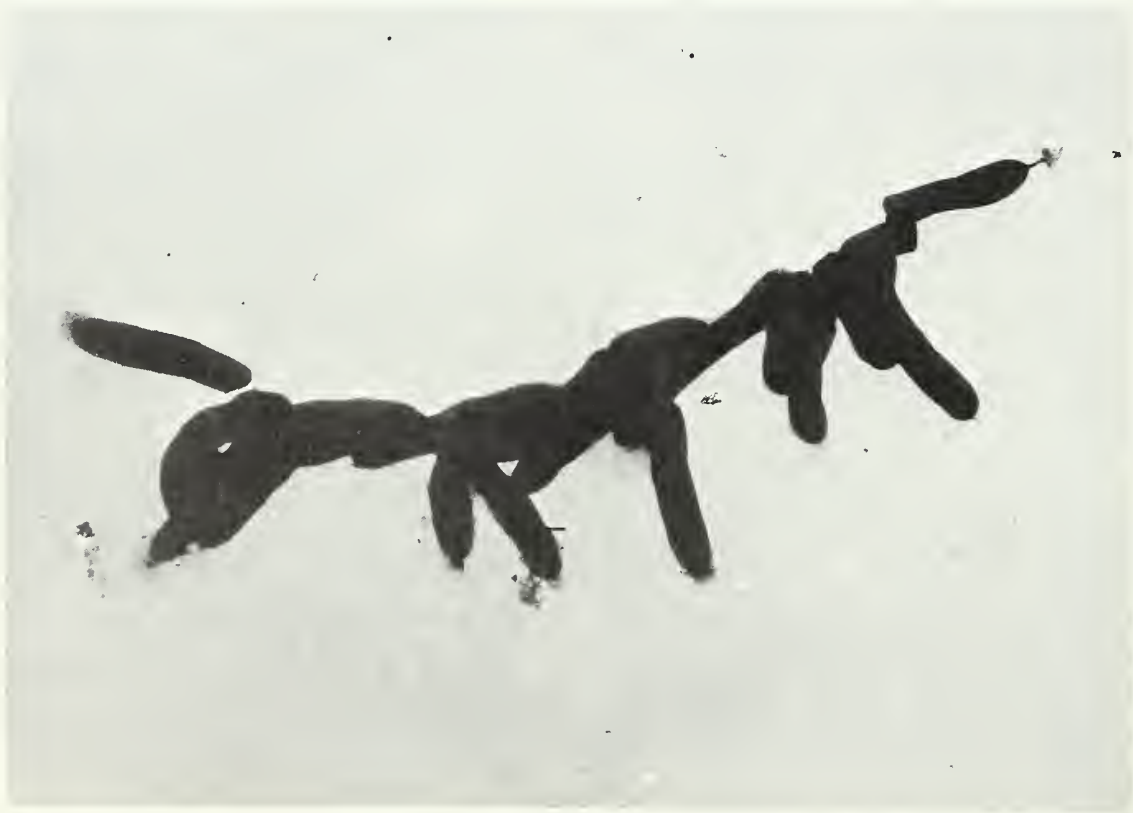
In one set of experiments with two closely related strains of soybean *Rhizobia*—one which would readily nodulate the variety Hardee and one which would not—the Poles successfully transformed the deficient strain with DNA from the infective strain. In four separate experiments, they inoculated Hardee with the treated cultures and obtained nodules on 20 out of 158 plants; no nodules occurred on plants inoculated with the untreated deficient strain.

In establishing the conditions necessary for maximum frequency of genetic transfer in *Rhizobium* by the transformation process, the Polish scientists concluded that the amino acids alanine, glycine, and serine were the most efficient additives in the culture medium.

Possible spin-offs of the Polish work would be the application of this approach to genetically improving beneficial bacteria in general. Also, harmful bacteria, such as *Agrobacterium tumefaciens* which can infect non-legumes and which is apparently related to *Rhizobium*, might someday be genetically deprived of harmful traits and given nitrogen-fixation capabilities from donor *Rhizobium*. In this way, nitrogen fixation might be introduced into non-legume crops.

The Polish project was conducted at the M. Curie-Sklodowska University, Lublin, under the direction of Dr. Zbigniew Lorkiewicz. □

Electron micrograph of the bacteria Rhizobium japonicum, *which fixes nitrogen in the root nodules of soybeans (PN–2009).*



The only delivery facility for this small retailer is his front door, which is at a bus stop on the main street. Trucks either park at the bus stop, forcing buses to discharge or take on passengers from the middle of the street, or they double-park, jamming traffic. In addition, this retailer cannot afford to buy a delivery truck so he uses a rental truck, which, in the long run, is probably the more expensive tactic (172K105–7).

GETTING FOOD TO THE INNER CITY

Trucks, workers, and boxes of poultry wait outside warehouse for personnel inside to arrange stock from previous load. Facilities do not permit handling more than one load at a time (172K107–11).

DURING THE PAST DECADE small food store owners have fought a losing struggle to continue operating in the inner city. Here, endless problems confront store owners and manifest themselves on resident consumers. High costs, high prices, and limited selections, are among the trademarks of these stores, but their existence is essential because they often are the only service available to the inner city people.

Realizing that a problem can't be solved until its cause is known, ARS researchers led by agricultural marketing specialists Dale L. Anderson and Raymond W. Hoecker, Hyattsville, Md., have sought the roots of problems faced by these ailing small food store owners.

Perhaps the foremost cause is the existing delivery system of goods from

wholesaler to retailer. This system resembles an octopus being strangled by its own tentacles of inefficiency, poor planning, and noncoordination.

Small retail merchants often place orders with many wholesalers. This increases delivery costs for each order. Lack of storage space makes for small orders, again increasing costs. One ARS study showed that delivery costs to wholesalers on orders of fewer than five cases delivered 11 to 15 miles averaged 53 cents a case; if the retailer purchased 25 cases, delivery cost to the wholesaler would be only 12.7 cents per case. Equivalent costs to wholesalers servicing large-scale retailers are more likely to be 7 cents or less.

Because many small retailers appear as poor credit risks, wholesalers often increase prices to cover expected credit losses. Frequently, wholesalers dealing in this market are those with high costs and poor delivery equipment.

Delivery costs are increased further because of narrow streets, lack of parking, inaccessible receiving facilities, high pilferage rates, poor handling, high damage claims, and severe traffic problems. All spell high costs for the retailer and, consequently, high prices for the consumer.

The smaller grocery wholesalers serving the ghetto areas may not carry fruits, vegetables, meats, or fish. This forces the retailer to purchase from several specialized wholesalers, increasing the number of trucks coming into his area.

Inadequate refrigeration equipment, poor delivery schedules, and overly long travel times contribute to the frequently poor quality of products sold by the small retailers. To remain in business, a small retailer may even turn to buying damaged goods at discount prices.

Although these problems seem to spiral without end, ARS researchers believe some solutions are possible. They suggest: coordinating activities of wholesalers, retail outlets, delivery firms and others involved in handling and distribution; improving handling and delivery equipment; improving delivery methods to reduce transit and receiving time; combining deliveries; and changing store designs to facilitate unloading.

Dr. Anderson and Dr. Hoecker picture new methods of delivering supplies to inner city stores. They project the assembly of a store's orders from different vendors, along with those of several other retail stores at one "receiving center." There, orders would be received, checked, and combined into a single delivery for each retail outlet.

Bread vendors now make as many as 18 separate bread and cake deliveries per week to a single store. Under the new plan, all bread deliveries for a store could be made to the "receiving center," and combined there with other orders, such as soft drinks and milk, into a single truck delivery to that store, made three to five times per week.

These "receiving centers" could be the cooperative effort of several retailers, a joint venture by many vendors, or a contractual arrangement by a single wholesaler with retailers and vendors. Such cooperation by inner city merchants could lead to more ambitious joint buying or to cooperative wholesaling ventures. Or it could lead

Top left: *At this wholesale warehouse, two trucks wait double parked in the street as two other trucks are unloaded. Drivers, paid by the hour, wait patiently (172K105–13).* ***Bottom left:*** *This is the main road servicing primary wholesalers who supply small retailers in the city. Large van blocks intersection tying up traffic on both sides while vehicles double-parked alongside the buildings effectively block access to loading areas. One retailer is forced to load his supplies in the street, creating further tie-ups. Many retailers servicing the inner city area cannot afford delivery trucks and use private vehicles such as station wagons. This means more trips and increased delivery costs as well as clogged traffic (172K103–13).*

to development of a new type of one-stop wholesaler specializing in serving low-income urban outlets.

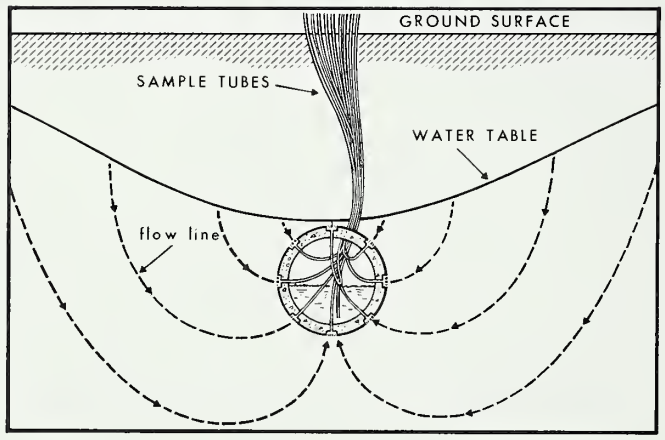
Reducing the number of small overlapping deliveries now made should reduce chances of pilferage and ease the work load in the store itself. Route schedules coordinated to decongest crowded streets should permit faster delivery. Trucks specifically designed for urban delivery, and compact, mobile refrigerated or insulated containers could be used to prevent deterioration of quality.

If such a program could be developed, it would result in a wider variety of more nutritious foods available to inner city residents at reasonable costs and with less truck traffic. □

Above: *Unloading facilities inside the wholesaler's warehouse often cannot handle incoming traffic. The meat on shackles has already spent quite some time exposed to the elements and to contamination from bypassers (172K103–24).* ***Left:*** *Lack of manuevering room makes unloading a truck lengthy and tedious. It is common practice to leave van doors open while unloading, thus negating any refrigeration. Because of the crowded conditions, goods are also damaged through bruising (172K103–33).*

Drain tile becomes

GROUNDWATER SAMPLER



Above: *Researcher points to spun glass filter over nylon pressure tube in sampler about to be installed (PN–2010).*
Left: *In the sampler, eight tubes draw water from around the drain while another samples water inside (PN–2011).*

An effective new sampling system for studying the directional groundwater flow to tile lines is both simple and low in cost.

By providing information on the composition of water coming into drain lines, the sampler may help scientists not only to relieve clogging of the lines but also to control pollution.

Although studies of groundwater flow to tile lines have been going on for years, the complicated nature of the groundwater flow system makes it difficult to obtain a water sample from more than one point on a given flow line. That, in turn, makes it difficult to determine how the quality of water is affected by the flow path.

Sampling within a tile line gives only a composite value for all the water entering the drain from all directions and from all upstream points on the drain.

The new sampler, devised by ARS scientists at Brawley, Calif., becomes a part of the tile drain system and provides external samples of the water approaching the tile from different directions around the circumference of the tile. Samples are taken from tubes at the soil surface without disturbing the soil, water, or crop.

The sampler is made by modifying a section of drain tile so it can be put into the regular drain line. Eight 1/8-inch holes, 45 degrees apart, are drilled near the ends of the tile, and nylon pressure tubing is connected to them from inside the tile. Spunglass filters over the holes prevent the entry of soil materials into the tubes. Those eight lines, plus one to sample the water inside the pipe, are led to the surface.

Agricultural engineer Lyman S. Willardson and soil scientist Burl D. Meek developed the sampler for use in their studies on chemical and biological changes in groundwater flow. Directional sampling is important in determining how the quality of water is affected by the flow path. Water entering the soil surface directly over the drain moves downward in a straight line to the drain. Water entering the soil surface midway between the drains travels a long curved path in arriving at the bottom of the drain. Water traveling from the midpoint is in contact with the soil for a much longer period of time and has a greater opportunity to attain chemical and biological equilibrium.

The sampler has already proved useful in the study of nitrate reduction and manganese movement toward tile drains. Manganese is one of the elements—along with iron—responsible for much of the clogging of tile lines experienced in the Imperial Valley of California and other areas. □

A better boll weevil trap

A NEW, INEXPENSIVE TRAP for boll weevils captured twice as many of these cotton pests as did standard sticky traps in several test locations.

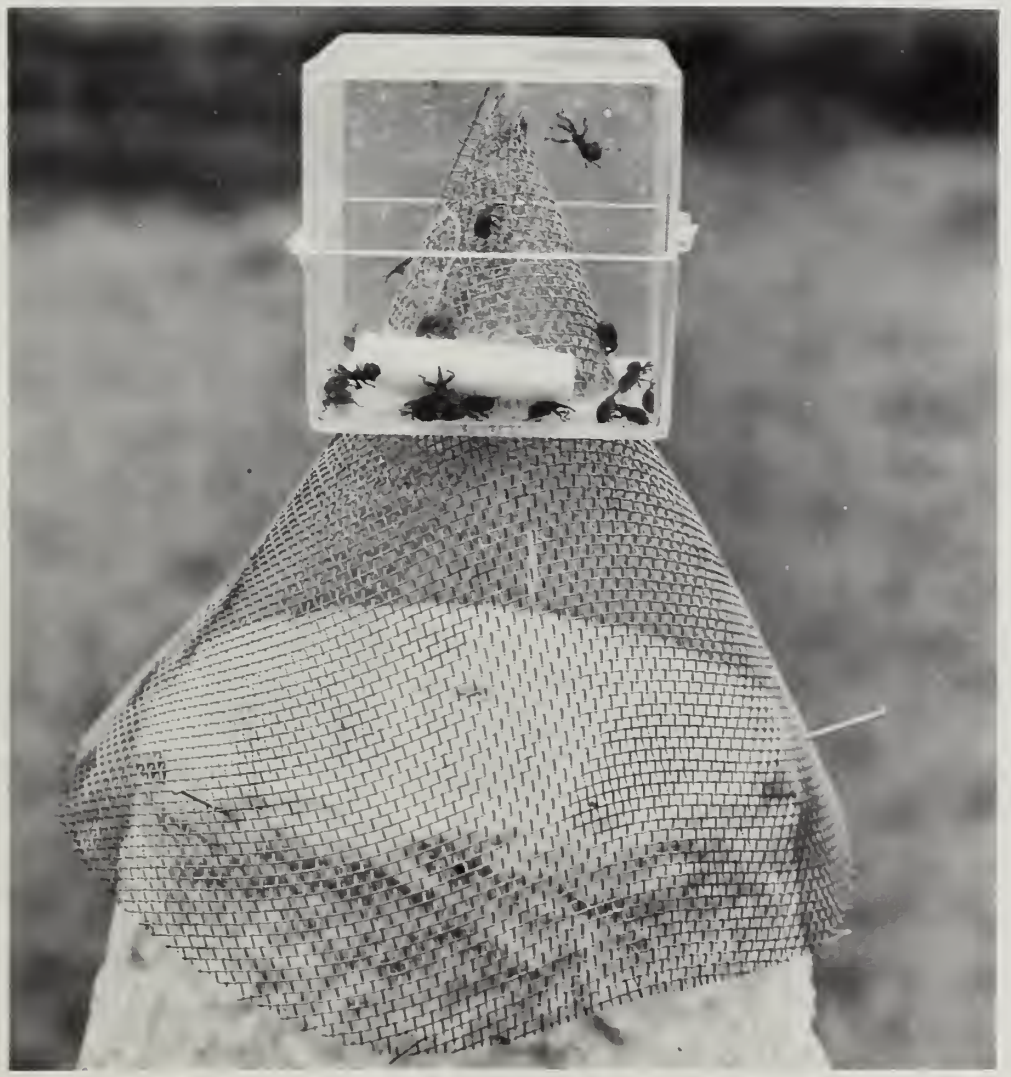
Designated the Leggett trap after its principal designer, ARS entomologist Joseph E. Leggett, the trap adapts a papier-mache liner used for cut flowers and is painted a bright yellow to attract boll weevils from the field. Live, caged weevils or grandlure, a synthetic sex attractant, placed at the narrow end of the cone lure the pests into a plastic or screen cage. The insects can then be collected or killed by a small amount of insecticide.

In preliminary tests, Mr. Leggett and ARS entomologist William H. Cross killed the trapped weevils with a small strip of plastic impregnated with dichlorvos. The fumes of this insecticide, released over a period of a week or longer, disappear with no residue on plants or in the soil. Wildlife would not be endangered because dead weevils that may have residues are confined in a cage not easily accessible to birds or animals.

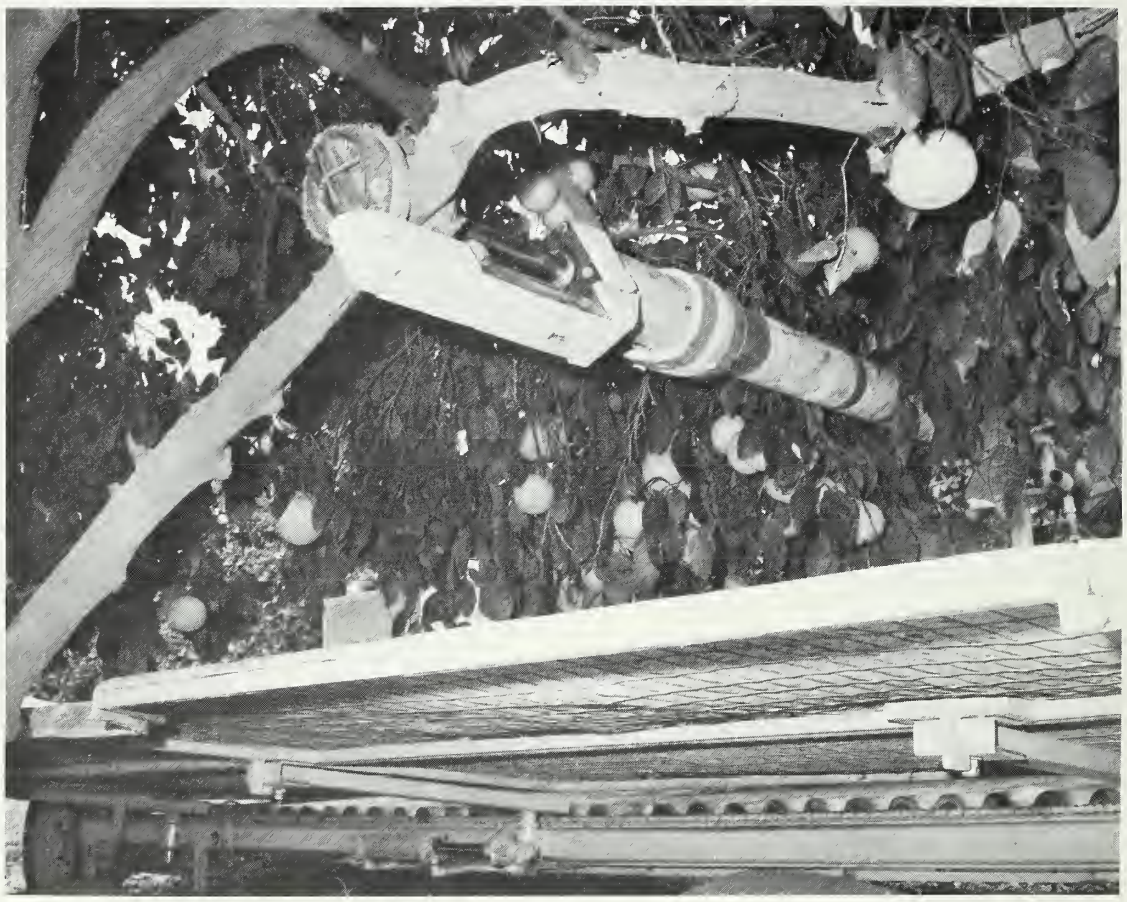
State and Federal entomologists tested the new trap in most weevil-infested, cotton-producing areas. In only one instance did sticky traps capture more boll weevils than did the Leggett trap. The scientists also found that the new trap captures fewer unwanted species of insects and, unlike sticky traps, lasts for a full season. Soil and debris blown against the sticky traps pose an additional maintenance problem that is eliminated with the Leggett trap.

USDA control program officials will employ several thousand of the new traps in the Pilot Boll Weevil Eradication Experiment underway in parts of Alabama, Louisiana, and Mississippi this year. □

Boll weevils attracted by lure in cylindrical white wick will crawl up under the lip of the screen cone, bypass the wick, and become trapped in the plastic box at top. The box and cone assembly can be exchanged quickly and weevils counted in the laboratory. In contrast, the entire sticky trap must be removed to the laboratory unless weevils are counted in the field (PN–2013).



Trap in the field. Each trap costs less than $1 and is durable enough to last the entire season. Sticky traps are cheaper but require refurbishing up to seven times a season in some areas (PN–2012).



With catching frame in position under the tree, limb shaker arm grips branch just before shaking (PN–2014).

SHAKEDOWN FOR DESERT GRAPEFRUIT

EFFORTS TO MECHANIZE the citrus harvest for fresh market outlets, underway in California since 1964, are starting to pay off.

A harvest system for desert grapefruit has been developed that combines a limb shaker, catching frame, and post-harvest fruit handling methods to harvest 12 to 15 trees per hour. The system removes 90 to 97 percent of the fruit with about 75 percent of the fruit free of significant mechanical injury. Harvest cost is estimated to be 15 cents per field box—9 cents a box less than the break-even cost of handpicking.

ARS agricultural engineers Paul F. Burkner and Joseph H. Chesson, in cooperation with the California Agricultural Experiment Station, Davis, modified for use on citrus trees an inertia-type limb shaker developed for olives by the station.

The shaker, mounted on a torsion bar assembly to minimize vibration to the frame, can swing on a 180-degree arc. The arm is attached to a carriage that moves on a track parallel to the tree rows. All movements for the carriage, arm, and shaker clamp are electro-hydraulically controlled from a console at the rear of the shaker. The shaker grasps the limb about one-fourth of the way up from its base, displaces it about 2 to 4 inches at about 350 cycles per minute for 1 to 3 seconds several times.

The catching frame is covered with ¾-inch sponge rubber attached to 2- by 4-inch welded wire mesh. The center

conveyor, which is also a catching surface, has padded bars with 1⅞-inch openings between bars. The conveyor reduces fruit injury by eliminating deadwood and leaves quickly. A device for detaching some of the longer stems can be added to the frame when required. So far, about 17 percent of the grapefruit are detached with stems, only slightly higher than from hand snapping.

Since the limb shaker and harvesting frame service one-half of the tree, the present system calls for two machines—frames—to be working a grove.

The frames are designed to be operated by a three-man crew, one man per frame plus a third man to assist with fruit handling and moving bins. The crew should harvest 150 to 188 field boxes—50 pounds per box—per hour with a 12.5 field box per tree yield. This compares with an average handpicking rate of 15 field boxes per man hour. In one test, the fresh market packout for mechanically harvested fruit was 50 percent, compared to 58 percent for the handpicked lot.

An important requirement of the harvesting system is pruning of trees and postharvest handling and grading of the fruit.

Grapefruit trees destined for mechanical harvesting will require deadwood removal and shaping for a successful shake harvest. Deadwooding reduces fruit injury in the tree. Shaping includes selecting three to five major scaffold limbs for shaking, and raising skirt 2½ feet above the ground for catching frame placement.

Shake-harvested fruit has a higher level of injury than handpicked fruit. Most of the injury is in the rind and does not affect internal quality. Fungicides and proper wax application can control much of the decay and dehydration due to injury. Mechanically harvested fruit, however, will require closer inspection by graders to sort out injured fruit. □

Filters against Marek's disease

SPECIALLY DESIGNED poultry houses with filters that stop tiny particles can prevent Marek's disease from infecting closed poultry flocks.

Marek's disease is an extremely contagious, highly fatal virus disease of chickens. The virus spreads rapidly among birds and can be carried in the air on particles of dust from chicken feathers. Previous tests have shown that exposing chickens to infected air for less than 30 minutes results in a high rate of infected birds.

ARS biologist Ben R. Burmester and veterinarian Richard L. Witter in East Lansing, Mich., found that filters catching 93 to 97 percent of the dust particles about 1 millimicron in size effectively prevent airborne Marek's disease from infecting susceptible chickens. The filters must be used in filtered-air, positive-pressure (FAPP) poultry houses (AGR. RES., Jan. 1970, p. 16). Such poultry houses are designed to maintain a higher air pressure inside the house than outside.

Dr. Burmester and Dr. Witter tested four filters, singly and in pairs, with different dust-catching capacities. Air from cages containing Marek's disease - infected chickens was passed through the filters into FAPP cages with highly susceptible chicks. The chicks were exposed to the infected filtered air for 14 days and then to regular filtered air. No antibodies or lesions as a result of Marek's disease virus were present in 8-week-old birds receiving infected air passed through filters that stopped particles 1 millimicron in size. In contrast, 132 out of 134 control birds exposed to infected air contracted Marek's disease.

In other trials, infected air that flowed through a filter passing 45 percent of the 1 millimicron dust particles caused a high incidence of disease. □

Economy dumper for peaches

A comparatively inexpensive hydro dumper designed to assist small-scale peach grower-packers in their struggle to remain independent is proving successful in tests conducted at a small commercial plant.

ARS industrial engineer W. Roy Forbus, Athens, Ga., studied the effective but quite expensive mechanisms presently used by large commercial packers to transfer peaches from pallet boxes to their packing lines. Then he and ARS engineering technician James H. Adams designed and constructed a dumper whose strength lies in its simplicity.

Most presently used dumpers are powered hydraulically. The pallet box is placed into a cage that is mechanically hoisted and rotated until the contents spill out into a water tank. Mr. Forbus' device consists of a mobile cage attached to an electric chain hoist which is trolly-mounted on a 6-inch I-beam supported above the tank. The two vertical I-beam supports at one end of the tank are bisected by a metal crossbar above the water so that they resemble a football goalpost. The cage itself is basically two L-shaped arms and a top that fits over the open end of the pallet box.

The mobility of the cage permits it to be brought to the box, which it grips, then raises with the chain hoist and manually positions above the stationary metal crossbar. The caged box is then lowered until the hooks at the bottom rear of the cage rest on the crossbar. As the box is lowered further, gravity causes it to rotate until its contents are emptied. Unlike conventional dumpers from which a box's contents avalanche into the water all at once, a trap door at the end of the top on Mr. Forbus' cage allows the contents to trickle out in an even flow, reducing damage by bruising.

Mr. Forbus' dumper does not require the use of a forklift truck as do conventional dumpers, greatly lowering costs to growers who wish to pack their own products. Fewer laborers are needed, and the dumper still handles 350 bushels of peaches per hour, a rate comparable to that provided by conventional dumpers. Mr. Forbus believes that his dumper could be adapted to handle any crop which is harvested in pallet boxes. □

Efficient new poultry washer

Poultry processors will be able to use less water yet get cleaner birds via a newly developed bird washer.

Most commercial washers currently used are not designed for maximum effectiveness. Poultry is conveyed through a tunnel lined on both sides with spray nozzles. The birds are deluged with water but, because of the random spray pattern used, a tremendous amount of water is required to get them washed clean.

ARS engineers Ken Whitehead and Rex E. Childs devised a poultry washer that uses a carefully designed spray pattern in which each nozzle directs a flat, jet spray at a specific area on each carcass. Preliminary tests run at the Richard B. Russell Agricultural Research Center, Athens, Ga., and at a commercial plant, showed that the birds not only appeared cleaner after passing through the washer, but the volume of water used is reduced from a range of 50 to 100 gallons per minute in a commercial washer to 25 to 30 gallons per minute in the experimental unit.

Now the engineers are working with ARS microbiologist James Thomson to confirm preliminary tests which showed a reduction in the microbial population on washed carcasses. □

AGRISEARCH NOTES

Moth-rearing hazard down the drain

Large-scale rearing of insects—especially adult moths—poses built-in hazards, but a uniquely designed filter may alleviate one problem.

The soft, fluffy wings on moths are covered with scales that can be dangerous to workers exposed to them. The fan-shaped dustlike scales have a barb on one end that may make the scales stick in the worker's lungs. Prolonged exposure could bring on respiratory problems.

When the moths are agitated, the beating of wings throws millions of scales into the air. Being almost weightless, the scales float around the room on currents of air for long periods and, consequently, have been hard to remove. Although respirators are worn, they provide incomplete protection.

ARS agricultural engineer Paul E. James and technician Hilding V. Anderson designed and built two prototype wing scale filters. They are in use at USDA's Pink Bollworm Laboratories in Brownsville, Tex., and Phoenix, Ariz.

The filter at Brownsville, operating for about 6 months, is reported to have significantly reduced airborne scales. The filters can be put in ventilation ducts or in booths where the moths are being handled.

Key component of the filter is a 24-by 10-inch drum made of 80-mesh stainless steel screen turning one revolution every seven minutes. As contaminated air is pulled through the drum by a high-pressure blower, the insect parts are deposited on the outside of the cylinder. The dusty drum slowly rotates through a stream of water which cleanses it and carries the wing scales down the drain.

Imitating queen keeps bees safe

By imitating electronically the "piping" sounds or vibrations that queen honey bees make, scientists may be able to protect these beneficial insects from exposure to pesticide spraying operations.

Observers first noted in 1814 that honey bees remain motionless during queen bee piping but not until 1970 was a way found to employ vibrations to immobilize the insects in their hives.

In tests at Tucson, Ariz., ARS entomologist Hayward G. Spangler and technician Martin M. McGaughey rotated a device that physically vibrated hives by sound among three beehives. The two hives not connected to the device were used as a comparison to the vibrating hive. To provide a measure of bee activity, entrances to each hive were fitted with pollen traps that withdrew part of the pollen from all bees entering the hives.

Hives vibrated for 4 hours showed a strong negative effect on pollen-collecting behavior of the bees. Only about 22 percent as much pollen was obtained from traps on vibrated hives as on the control hives. Related tests also showed that the bees stopped collecting nectar when hives were vibrated.

By employing a device to mimic the queen's vibrations, beekeepers might be able to confine most of the bees to the hive whenever desired. Before practical applications of such devices can be recommended, further experiments must be made to demonstrate the feasibility of this approach.

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Brittle bones in broilers

Lack of exercise is an important cause of brittle bones in caged broilers.

Previous studies by ARS scientists showed that caged broilers had weaker bones than did floor-raised birds, and lack of exercise was suspected as a contributing cause.

To test their supposition, ARS poultry scientists Lloyd H. Littlefield, Thomas E. Nightingale, and John W. Merkley, Georgetown, Del., fashioned plastic casts and harnesses to immobolize one wing on each of six 20-week-old broilers. The birds were placed on litter-covered floors and were killed after 16 days and examined.

Wings with casts weighed significantly less and the humerus, ulna, and radius bones had significantly lower breaking strengths than bones in uncasted wings.

Bleaching grains for easier grading

The whiter the kernel of grain, the easier it is to evaluate germ damage. A newly developed bleaching procedure thus promotes easier, quicker, and more accurate determination of germ damage than visual inspection alone.

Food storage and final product quality require accurate germ damage assessment. Currently, most grain is visually inspected, requiring tedious and time-consuming scraping of the germ and often resulting in overlooking germ damage.

ARS and Kansas Agricultural Experiment Station researchers at Manhattan developed the new procedure, which uses a 6-percent sodium hypochlorite (NaOCl) bleach. The procedure reduces grading time for 30 grams of grain sorghum, wheat, and rye by 23, 9, and 59 minutes respectively. It also permits easier assessment of sorghum grain pigment.

In their study, the researchers diluted a 12-percent NaOCl commercial bleach to concentrations of 2, 4, 6, 10, and 11 percent. NaOCl has been used at a 2-percent strength in other studies.

Tests showed that kernels bleached with less than 5-percent NaOCl resemble frostbitten wheat rather than the polished kernels which result from a 6- to 11-percent solution. Ideal bleach time ranges from 3 to 19 minutes. Less time leaves kernels too dark; longer time causes germ deterioration.

Feedlot runoff on grass

Yearly variations in managing the runoff from beef cattle feedlots may cause differences in the response of grasses to this source of nutrients.

In Nebraska studies, 1970 winter runoff from feedlots channeled to settling basins, then collected in ponds below was applied to nine kinds of grass seedlings. The seedlings had good growth and foliage color throughout a 42-day test. A similar test using runoff collected in the winter of 1969 had caused wilting beginning with the third week after application. Settling basins were not used in this test.

ARS agricultural engineer Conrad B. Gilbertson and University of Nebraska botanist Melvin B. Satterwhite suspect that the large amount of nitrogen (357 pounds per acre) was an important factor in the 1969 results. Adverse winter conditions that year resulted in snowmelt runoff that transported large amounts of solids into the ponds.

Studies by others indicate that forage production and protein improvement will taper off when the ammonia nitrogen exceeds 310 pounds per acre. If settleable solids had been removed, such as in settling basins, the ammonia form of nitrogen would have been reduced.

These results are now being further tested in a large-scale feedlot operation.

Correction: French-fried yams

Our February issue carried an article entitled "French-Fried Yams" which stated that yam-type sweet potatoes botanically are *Spomoea batatos*. The correct name is *Ipomoea batatas*.

When reporting research involving pesticides, this magazine does not imply that pesticide uses discussed have been registered. Registration is necessary before recommendation. Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if not handled or applied properly. Use all pesticides selectively and carefully.

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